PA-32674
引用①

CONTROL APPARATUS OF WATER TREATMENT PLANT

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- European:

Application number: JP19910097144 19910426

Priority number(s): JP19910097144 19910426

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Abstract of **JP4326992**

PURPOSE:To control a blow amount of air for keeping the DO concn. of an aeration tank constant by mounting an operation means calculating the correction factor to the set value of the blow amount of air from a DO deviation value, a DO change rate and air magnification by inference and an operation means calculating the set value of the blow amount of air from an air amount indicated value, an air blow amount correction value and the correction factor. CONSTITUTION:A DO densitometer 6 is arranged to an aeration tank 2 and the indication value CPV thereof is transmitted to a control apparatus 7 along with the indication value QS of a flowmeter 1 and the indication value QA of an airflow meter 3 and the control apparatus 7 calculates the objective value QSV of the blow amount of air by operation and, on the basis of this value, the air amount of a blower 4 is controlled. The correction factor K correcting the set value of the blow amount of air is inputted to an operation means 12 calculating an air blow amount set value QAN along with the indication value QA of the airflow meter 3 and the air blow amount correction value (g) being the output of an operation means 11. The calculated air blow amount set value QAN is set to the blower 4 from the control apparatus 7 and the blow amount of air of the blower 4 is controlled on the basis of the set value QAN.

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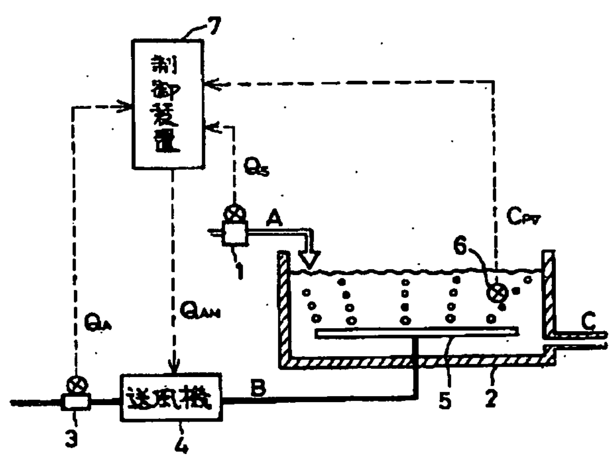
(54)【発明の名称】　水処理プラントの制御装置

(57)【要約】

【目的】曝気槽を用いて原水を浄化する水処理プラントの制御装置において、大雨などの負荷変動に対してもＤＯ濃度の変化が少くなるような送風量の制御を行う。

【構成】目標値に対するＤＯ濃度偏差およびＤＯ濃度の変化率から送風補正量を演算する手段、ＤＯ濃度偏差、ＤＯ濃度変化率、および原水流量に対する送風量の比からファジィ推論によって送風量補正値に対する修正係数を演算する手段、および上記送風補正量および修正係数から送風量設定値を演算する手段を設け、この算出された送風量設定値に基づいて送風機の風量を制御する。



【特許請求の範囲】

【請求項1】　曝気槽を用いて原水を浄化する水処理プラントの制御装置において、曝気槽のＤＯ濃度の指示値と目標値との差であるＤＯ偏差値を計算する演算手段と、ＤＯ濃度指示値の変化する速さであるＤＯ変化率を計算する演算手段と、曝気槽に送られる空気の流量指示値を曝気槽に流入する原水の流量指示値で除算して空気倍率を計算する演算手段と、上記計算されＤＯ偏差値およびＤＯ変化率から送風量補正値を計算する演算手段と、上記計算されたＤＯ偏差値、ＤＯ変化率、および空気倍率から推論によって送風量設定値に対する修正係数を計算する演算手段と、上記風量指示値、上記送風量補正値、および上記修正係数から送風量の設定値を計算する演算手段とを備えたことを特徴とする水処理プラントの制御装置。

【発明の詳細な説明】

【０００１】［発明の目的］

【０００２】

【産業上の利用分野】本発明は、曝気槽を用いて汚水や天然水などの原水を浄化する水処理プラントの制御装置にかかり、特に曝気槽のＤＯ（溶存酸素）濃度を一定に保持するための送風量の制御に関するものである。

【０００３】

【従来の技術】鉄イオンやマンガンイオンなどの還元性無機物を大量に含む天然水を浄化する水処理プラント、または活性汚泥を用いて一般の下水や有機性廃水などの汚水を処理する水処理プラントにおいては、曝気槽に流入した天然水や汚水は、曝気されることによって酸化され、酸化物や汚泥となって固形化し、沈殿池や濾過池でこれらの固形物が水と分離されることによって清澄となる。このような水処理プラントにおいては曝気の条件すなわち曝気槽のＤＯ濃度によって、浄化の効果、運転の安定性、およびエネルギ消費量が影響される。すなわち、浄化の効果を高め、かつ過曝気を防止して送風機のエネルギ消費量を節減するためには、曝気槽のＤＯ濃度を一定の値に保持する必要がある。

【０００４】従来、曝気槽のＤＯ濃度を一定に保持するための制御方法には、曝気槽にＤＯ濃度計を設け、その指示値が目標値になるように送風量を自動的に調節するフィードバック制御方法、フィードバック制御においてその制御出力を原水の流量に応じて補正するカスケード制御方法、さらにフィードバック制御またはカスケード制御において制御入力であるＤＯ濃度の偏差（ＤＯ濃度の目標値とＤＯ濃度計の指示値との差）を曝気槽の他のプロセス値例えば懸濁物濃度によって補正する方法などがある。

【０００５】

【発明が解決しようとする課題】しかしながら、上記従来の方法はすべてＰＩＤ調節計などによるフィードバック制御を基本とするもので、従って必然的に応答遅れがあり、原水の流入流量や有機物濃度または還元性無機物の濃度などの負荷変動すなわち制御の外乱が比較的小さい場合は、その応答遅れは十分短かい時間内で補償されるが、大雨などによって外乱が大きくなると、応答遅れのほかにオーバシュートや振動現象が発生し、曝気槽のＤＯ濃度を目標値に制御することができなくなる。

【０００６】さらに、ＤＯ濃度計の指示値が所定値以下のときは送風を行い、所定値以上のときは送風を停止するオンオフ制御を用いたものもあるが、この場合も応答遅れが大きいので大雨などによる急激な負荷変動があると送風が遅れてＤＯ濃度の著しい低下を招くと共に、大雨が止んだときは逆に負荷が急降下して過曝気の状態になり、ＤＯ濃度の異常上昇を招くという問題がある。

【０００７】本発明は、上記従来方法の問題点を考慮してなされたもので、負荷変動に対してより高精度かつより安定に送風量を制御できる合理的な水処理プラントの制御装置を提供することを目的としている。

［発明の構成］

【０００８】

【課題を解決するための手段と作用】本発明は、曝気槽を用いて原水を浄化する水処理プラントの制御装置において、曝気槽にＤＯ濃度計を設け、その指示値と目標値との差であるＤＯ偏差値を計算する演算手段と、上記ＤＯ濃度計の指示値の変化する速さであるＤＯ変化率を計算する演算手段と、曝気槽に流入する原水の流量を測定する流量計の指示値で、曝気槽に送る空気の流量を測定する風量計の指示値を除算して空気倍率を算出する演算手段と、上記算出されたＤＯ偏差値を用いて送風量補正値を計算する演算手段と、上記ＤＯ偏差値、ＤＯ変化率、および空気倍率から推論して送風量の設定値を修正する修正係数を計算する演算手段と、上記風量計の指示値、送風量補正値、および修正係数から送風量の設定値を計算する演算手段とを備えると共に、上記修正係数の推論はファジィ理論を用い経験的知識を加味して行うようにしたものである。

【０００９】

【実施例】本発明の一実施例を図１に示す。図１において、原水は流量計１が備えられている水路Ａから曝気槽２に流入し、風量計３と送風機４が設置されている送風管Ｂから散気管５を通して散気された空気によって曝気され、空気中の酸素による酸化をうけたあと水路Ｃを通って図示しない沈殿池または濾過池に導かれる。

【００１０】曝気槽２にはＤＯ濃度計６が設置されており、その指示値C_{PV}は上記流量計１の指示値Q_Sおよび風量計３の指示値Q_Aとともに制御装置７に伝送され、制御装置７は下記の演算によって送風量の目標値Q_{SV}を算出し、この値に基づいて送風機４の風量を制御する。

【００１１】図２は制御装置７で行われる計算の演算手段を示したもので、ＤＯ濃度計６の指示値であるＤＯ濃度C_{PV}は、次式（１）でその目標値C_{SV}との差であるＤ

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Ｏ偏差値Ｅｔを計算する演算手段８に入力されると同時に、次式（２）でＤＯ濃度CPVの変化する速さであるＤＯ変化率ｄを計算する演算手段９に入力される。

$E_t = C_{PV} - C_{SV}$ ………（１）

$d = C_{PV} - C_{PV}'$ ………（２）

ここで、C_{PV}' は前回制御時のＤＯ濃度である。

【００１２】次に、原水の流量を測定する流量計１の指示値である原水流量Q_S と、曝気槽２に送る空気の流量を測定する風量計３の指示値である送風量Q_A が、次式（３）で除算して得られる空気倍率ｅを計算する演算手段10に入力される。

$e = Q_A / Q_S$ ………（３）

上記演算手段８と演算手段９それぞれの計算出力であるＤＯ偏差ＥｔとＤＯ変化率ｄは、これらを用いて次式（４）により送風量補正値ｑを計算する演算手段11に入力される。　＊

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＊ $q = K_P \cdot d + K_I \cdot E_t$ ………（４）

ここで、K_P 、K_I は制御定数であり、水処理プラントに特有の値である。

【００１３】さらに、上記演算手段８、演算手段９、および演算手段10のそれぞれの計算出力であるＤＯ偏差値Ｅｔ、ＤＯ変化率ｄ、および空気倍率ｅは、これらの値から後述のようなファジィ推論によって下記送風量の設定値を修正する修正係数Ｋを計算する演算手段12に入力される。

【００１４】演算手段12においては、図３（Ａ），（Ｂ），（Ｃ）に示すようなメンバーシップ関数でそれぞれのグレードが計算される。次に、例えば下記のような推論規群の中から、その条件部が成立する推論規則を、所定の制御周期ごとに選出し、メンバーシップ関数の合成計算を、例えば加重平均方法を用いて行い、図３（Ｄ）に従って修正係数Ｋを求める。

ＩＦ（E_t ＝ＳＭ）ＡＮＤ（ｄ＝ＭＭ）ＡＮＤ（ｅ＝ＳＡ）ＴＨＥＮ（Ｋ＝ＭＬ）

ＩＦ（E_t ＝ＭＭ）ＡＮＤ（ｄ＝ＭＭ）ＡＮＤ（ｅ＝ＭＭ）ＴＨＥＮ（Ｋ＝ＭＭ）

ＩＦ（E_t ＝ＬＡ）ＡＮＤ（ｄ＝ＭＬ）ＡＮＤ（ｅ＝ＭＭ）ＴＨＥＮ（Ｋ＝ＳＡ）

ＩＦ（E_t ＝ＭＬ）ＡＮＤ（ｄ＝ＳＭ）ＡＮＤ（ｅ＝ＭＭ）ＴＨＥＮ（Ｋ＝ＭＭ）

ＩＦ（E_t ＝ＭＬ）ＡＮＤ（ｄ＝ＳＭ）ＡＮＤ（ｅ＝ＭＳ）ＴＨＥＮ（Ｋ＝ＭＭ）

ＩＦ（E_t ＝ＭＬ）ＡＮＤ（ｄ＝ＳＭ）ＡＮＤ（ｅ＝ＭＬ）ＴＨＥＮ（Ｋ＝ＭＳ）

ＩＦ（E_t ＝ＭＭ）ＡＮＤ（ｄ＝ＭＭ）ＡＮＤ（ｅ＝ＳＡ）ＴＨＥＮ（Ｋ＝ＬＡ）

・・・・・・・・・・・・・・・・・

・・・・・・・・・・・・・・・・・　…………（５）

求められた修正係数Ｋは、風量計３の指示値Q_A および図２の演算手段11の出力である送風量補正値ｑとともに、次式（６）によって送風量設定値Q_{AM}を計算する演算手段12に入力される。

$Q_{AM} = K \cdot (Q_A + q)$ …………（６）

上述の演算によって求められた送風量設定値Q_{AM}は、図１の制御装置７から送風機４に設定され、これによって送風機４の送風量が制御される。

【００１５】図４は本発明の制御装置を活性汚泥法下水処理プラントに適用した結果を示すグラフであり、グラフ（Ａ）は活性汚泥法下水処理プラントの曝気槽に流入する原水の流量Q_S の変動パタンの一例を示し、グラフ（Ｂ）および（Ｃ）はそれぞれ本発明の制御装置を用いた場合と、従来のＤＯ一定フィードバック制御の場合のＤＯ濃度の変動を示している。

【００１６】図から分るように後者の場合は、負荷の急上昇および急降下時の応答の遅れが大きく、活性汚泥の酸素利用形態の変動に追随できていない。これに対して本発明の制御装置を用いた場合は、活性汚泥法下水処理プラントにおける経験を規則化した推論によって計算した修正係数で送風量の設定値が補正されるので、ＤＯ濃度が極めて安定している。

【００１７】

【発明の効果】以上説明したように本発明によれば、負荷の変動が大きいときにも曝気槽のＤＯ濃度が安定し、従って活性汚泥が常時必要なときに必要な量の酸素を利用できるので処理の効率を高く維持でき、これによって下水処理水の水質を安定させ、より浄澄な処理水とすることのできる高性能の水処理プラントの制御装置が得られる。

【図面の簡単な説明】

【図１】本発明の一実施例を示す構成図。

【図２】本発明における制御演算の手順を示す図。

【図３】本発明の一構成要素である送風量の設定値を修正係数を計算する演算手段の作用を説明するグラフ。

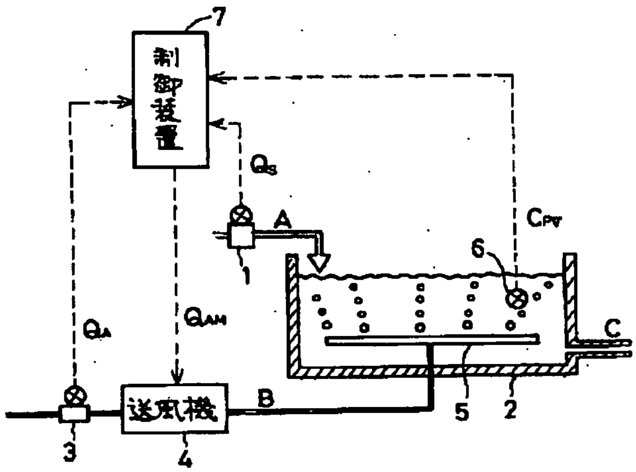
【図４】本発明を活性汚泥法下水処理プラントに適用し

たときの制御結果を説明するグラフ。

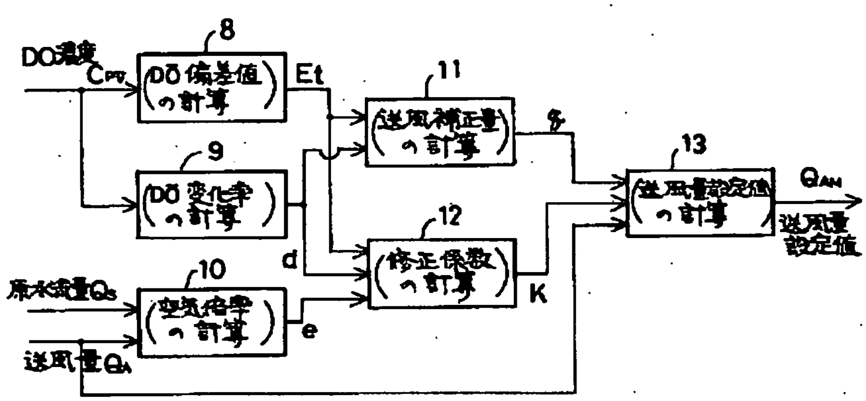
【符号の説明】

1…流量計、2…曝気槽、3…風量計、4…送風機、5…散気管、6…DO濃度計、7…制御装置、8～13…演算手段。

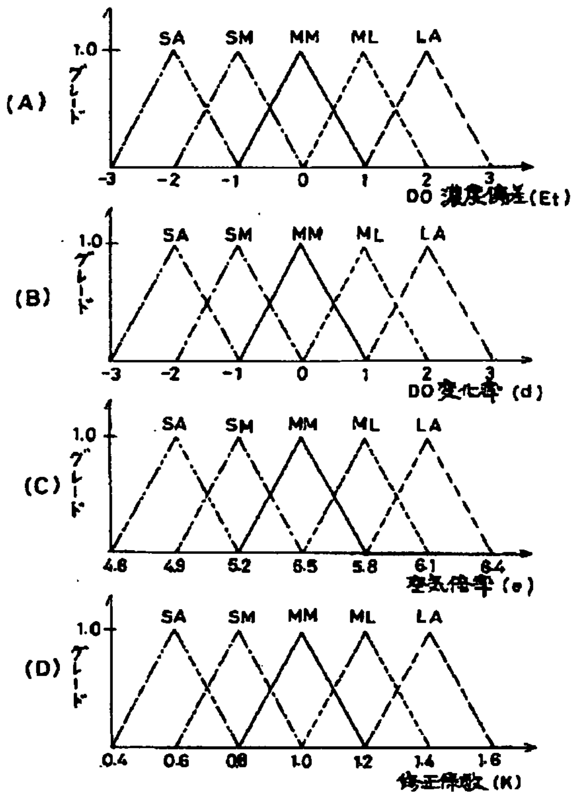
【図1】



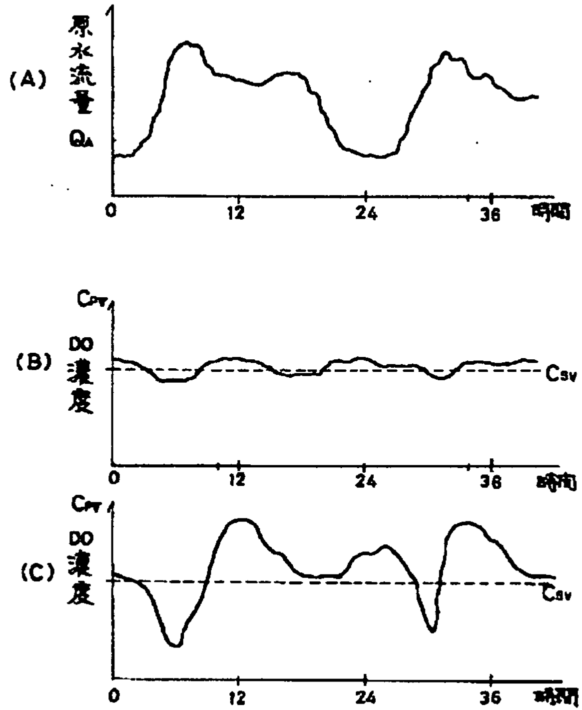
【図2】



【図3】


SA
SM
MM
ML
LA
1.0
グレード
(A)
-3 -2 -1 0 1 2 3
DO 濃度偏差(Et)
(B)
DO変化率 (d)
(C)
4.6 4.9 5.2 5.5 5.8 6.1 6.4
空気倍率 (e)
(D)
0.4 0.6 0.8 1.0 1.2 1.4 1.6
修正係数 (K)

【図4】


(A)
原水流量
Q_A
0 12 24 36 時間
(B)
C_{PV}
DO濃度
C_{SV}
(C)

Full English translation of text portions of JP-A-4-326992 (Ref.1)

(page 2, left column, line 1 to page 4, right column, line 2)

SPECIFICATION

[Title]

CONTROL APPARATUS OF WATER TREATMENT PLANT

[Claims]

1. A control apparatus of water treatment plant for purifying raw water using an aeration tank, comprising: operation means calculating a deviation value of DO that is difference between indication value and objective value of DO concentration in the aeration tank; operation means calculating a change rate of the DO that is a changing speed of an indication value of the DO concentration; operation means calculating air magnification that is indication value of a flow amount of air send into the aeration tank divided by indication value of a flow amount of raw water; operation means calculating air blow amount correction value by the calculated DO deviation value, DO change rate, and multiplication constant of air; operation means calculating a correction factor for the air blow amount correction value by means of inference using the calculated DO deviation value, the DO change rate, and the air magnification; and operation means calculating air blow amount set value by the indication value of the flow amount of air, the air blow amount correction value, and the correction factor.

[Detailed Description of Invention]

[0001]
(Object of the Invention)

[0002]
[Industrial Applicability]
The present invention relates to a control apparatus of a water treatment plant for purifying raw water such as sewage or natural water using an aeration tank, in particular it relates to control of the blow amount of air for keeping DO (dissolved oxygen) concentration of the aeration tank to be constant.

[0003]
[Prior Art]

In a water treatment plant for purifying natural water containing large quantities of reductive inorganic substances such as iron-ion or manganese-ion, or for treating sewage such as common black water or organic wastewater, using active sludge, the natural water or sewage flown into an aeration tank is oxidized by being aerated, and made into oxides or sludge and solidified, and the solid matter is separated from water in a settling basin or filtration basin, thus, resulting in clean water. In such a water treatment plant, a condition of aeration that is DO concentration in the aeration tank, affects the effect of purification, the stability of operation, and the amount of energy consumption. In other words, in order to reduce the amount of energy consumption by enhancing the effect of purification and preventing over aeration, it is necessary to keep the DO concentration of the aeration tank to be a constant value.

[0004]

Conventionally, there have been control methods for keeping the DO concentration constant; such as a feed back control method in which a DO densitometer is provided, and the air blow amount is automatically adjusted so that indication value of the meter to be objective value; a cascade control method in which the controlling output in feed back control is corrected depending on the flow amount of the raw water; and further a method in which, in the feed back control or cascade control, the deviation of the DO concentration(the difference between the objective value of the DO concentration and the indication value of the DO densitometer) that is the controlling input thereof is corrected by the other process value of the aeration tank, e.g. the concentration of suspended solids.

[0005]

[Problems to be solved by the Invention]

However, all of the above mentioned prior art examples are based on feed back control by a PID regulator etc., thus, there is necessarily delay in response. Therefore, although when fluctuation in load such as the flowing amount of the raw water, the concentration of organic substances, or the concentration of reductive inorganic substances, that is the disturbance of control, is relatively small, the delay is compensated in sufficiently short time, when the disturbance becomes large due to heavy rain etc., not only the delay in response but also an overshooting or vibration phenomenon occurs, thus, disabling the DO concentration of the aeration tank to be controlled to be objective value.

[0006]

Further, although there is a method using on-off control in which when the indication value of the DO densitometer is equal to or smaller than predetermined value, air is blown, and when the indication value is equal to or greater than the predetermined value, air blow is stopped, in this case there is also a problem in that since the delay in response is also large, if abrupt fluctuation in load due to heavy rain etc. occurs, air blowing is delayed, causing the DO concentration to be reduced significantly, and on the contrary, when the heavy rain is stopped the load decreases abruptly to cause an over aeration state, causing the DO concentration to be increased abnormally.

[0007]

The present invention is performed in consideration of the above problems in the prior art methods, and the object of the present invention is to provide a reasonable control apparatus of water treatment plant which can control the blow amount of air in higher accuracy and more stably against fluctuation in load.

(Constitution of the Invention)

[0008]

[Means for solving the Problems and Action]

In the present invention, the control apparatus of water treatment plant for purifying raw water using an aeration tank, includes: operation means calculating a DO deviation value that is difference between indication value and objective value of DO concentration in the aeration tank; operation means calculating DO change rate that is the changing speed of the indication value of the DO concentration; operation means calculating air magnification that is indication value of an airflow meter measuring the flow amount of air sent into the aeration tank divided by indication value of a flowmeter measuring the flow amount of raw water flowing into the aeration tank; operation means calculating air blow amount correction value using the calculated DO deviation value; operation means calculating a correction factor to the set value of the blow amount of air from the DO deviation value, the DO change rate, and the air magnification by inference; and operation means calculating set value of t the blow amount of air from an air amount indication value, the air blow amount correction value, and the correction factor, and the inference of the above correction factor is performed using fuzzy theory and by adding experimental knowledge.

[0009]

[Embodiment Example]

An embodiment example of the present invention is illustrated in Fig. 1. In Fig. 1, raw water flows from a water passage A to an aeration tank 2, is subjected to aeration by air diffused from an air blowing pipe B provided with an airflow meter 3 and a blower 4 through an air di ffusing pipe 5, oxidized by oxygen in air, and subsequently, guided into a settling basin or a filtration basin (not illustrated in the figure) through a water passage C.

[0010]

In the aerati on tank, a DO densitometer 6 is disposed, the indicated value C_{PV} thereof together with the indicated value Q_S of the above flow meter 1 and the indicated value Q_A of the above airflow meter 3 are transmitted into a control apparatus 7, which calculates the objective value Q_{SV} of the blow amount of air by the following calculation, and, based on the calculated value, controls the flow amount of an air blower 4.

[0011]

Fig. 2 indicates operation mea ns of calculations executed in the control apparatus 7, the DO concentration C_{PV} that is the indication value of the DO densitometer 6 is input into operation means 8 calculating DO deviation value E_t that is the difference between the indication value and the objective value C_{SV} thereof by the following formula (1), and operation means 9 calculating DO change rate d that is the changing speed of the DO concentration C_{PV} by the following formula (2), at the same time.

$E_t = C_{PV} - C_{SV}$ -------------------------------------- (1)

$d = C_{PV} - C_{PV}'$ -------------------------------------- (2)

Where, C_{PV}' is the DO concentration at the time of the former control.

[0012]

Next, the flow amount Q_S of raw water that is the indication value of the flowmeter 1 measuring the flow amount of raw water, and the air blow amount Q_A that is the indication value of the airflow meter 3 measuring the flow amount of air sent into the aeration tank 2, are input into operation means 10 calculating air magnification e obtained by the following division formula (3):

$e = Q_A / Q_S$ -------------------------------------- (3)

DO deviation E_t and DO change rate d that are calculated

outputs of the operation means 8 and 9, respectively, are input into operation means 11 calculating air blow amount correction value q by using these and by the following formula (4):

$$q = K_p \cdot d + K_i \cdot E_t \text{ ----------------------------- } (4)$$

Where, K_p and K_i are control constants and values peculiar to a water treatment plant.

[0013]

Further, the DO deviation value E_t, the DO change rate d, and the air magnification e that are calculated outputs of the operation means 8, 9 and 10, respectively are input into below described operation means 12 calculating a correction factor K which corrects the set value of the blow amount of air from these values by fuzzy inference as described below.

[0014]

In the operation means 12, each grade of members is calculated using membership functions as illustrated in Fig. 3A, 3B and 3C. Next, for example, from the following group of inference regulations, an inference regulation in which the condition part of a membership function is satisfied is selected every predetermined control periods, and combination calculation of the membership functions is performed using, for example, weighted average method, and the correction factor K is obtained according to Fig. 3D.

IF (E_t = SM) AND (d = MM) AND (e = SA) THEN (K = ML)
IF (E_t = MM) AND (d = MM) AND (e = MM) THEN (K = MM)
IF (E_t = LA) AND (d = ML) AND (e = MM) THEN (K = SA)
IF (E_t = ML) AND (d = SM) AND (e = MM) THEN (K = MM)
IF (E_t = ML) AND (d = SM) AND (e = MS) THEN (K = MM)
IF (E_t = ML) AND (d = SM) AND (e = ML) THEN (K = MS)
IF (E_t = MM) AND (d = MM) AND (e = SA) THEN (K = LA)
....
....
------ (5)

The obtained correction coefficient K, the indication value of the air flow meter Q_A, and the air blow amount correction value q that is the output of the operation means 11 in Fig. 2 are input into the operation means 12 calculating air blow amount set value Q_{AM} by the following formula (6):

$$Q_{AM} = K \cdot (Q_A + q) \text{ ------------------------------ } (6)$$

The air blow amount set value Q_{AM} obtained by the above mentioned operation is set in the blower 4 from the control apparatus 7, and this causes the blow amount of air of the blower 4 to be controlled.

[0015]

Figs. 4A, 4B and 4C are graphs illustrating the results when the control apparatus of the present invention is applied to an active sludge method-black water treatment plant, respectively; Fig. 4A is a graph illustrating an example of fluctuation pattern of the flow amount Q_s of raw water flowing into the aeration tank of the active sludge method-black water treatment plant; and Figs. 4B and 4C are graphs illustrating fluctuation of DO concentration when the control apparatus of the present invention is used, and when prior art DO constant feed back control is used, respectively.

[0016]

As is clear from the figures, in the latter case, since when the load is increased abruptly and decreased abruptly, delay in response is large, it is not impossible to follow the fluctuation of the oxygen utilizing mode of active sludge. On the contrary, when the control apparatus of the present invention is used, since the set value of the air blow amount is corrected with a correction factor calculated by inference in which experiences in the active sludge method-black water treatment plant are put into regulations, the DO concentration is very stable.

[0017]

[Effect of the Invention]

As described above, according to the present invention, since even if fluctuation in load is large, the DO concentration in an aeration tank is stabilized, thus, active sludge can always utilize needed volume of oxygen when it is necessary, efficiency in treatment can be kept in high level, this enables a high performance control apparatus of water treatment plant to be obtained, which can stabilize the quality of the treated black water and cause the treated water to be more clear.

[Brief Description of the Drawings]

[Fig. 1] is a block diagram illustrating an embodiment example of the present invention.

[Fig. 2] is a view illustrating a procedure of control operation in the present invention.

[Fig. 3] Figs. 3A to 3D are graphs describing operation means calculating air blow amount set value and correction factor, which is a constituent of the present invention.

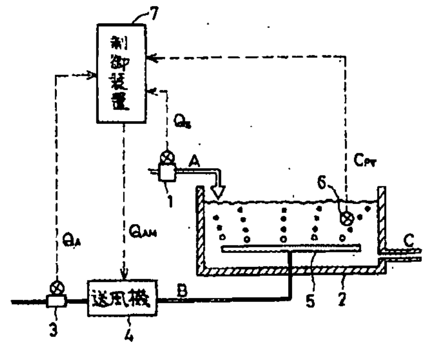
[Fig. 4] Figs. 4A to 4C are graphs describing controlled results when the present invention is applied to

an active sludge method-black water treatment plant.

[Description of the Reference Numerals]

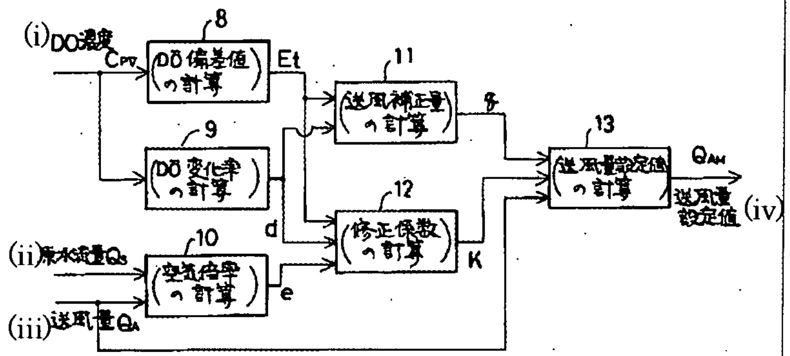
1	FLOWMETER
2	AERATION TANK
3	AIRFLOW METER
4	BOLWER
5	AIR DISFFUSING PIPE
6	DO DENSITOMETER
7	CONTROL APPARATUS
8 to 13	OPERATION MEANS

[Fig.1]



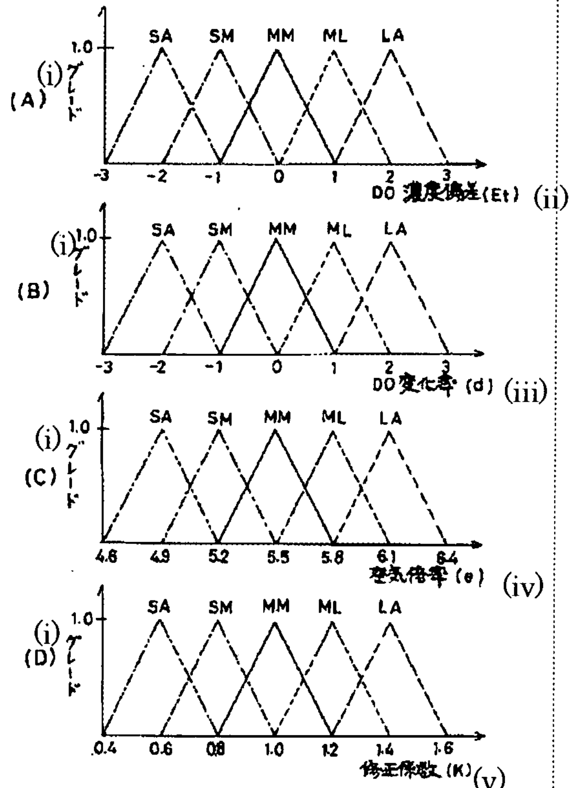
4 BLOWER
7 CONTROL APPARATUS

[Fig.2]



(i)	DO CONCENTRATION, C_{PV}
(ii)	FLOW AMOUNT OF RAW WATER, Q_S
(iii)	BLOW AMOUNT OF AIR, Q_A
(iv)	AIR BLOW AMOUNT SET VALUE, Q_{AM}
8	CALCULATION OF DO DEVIATION VALUE
9	CALCULATION OF DO CHANGE RATE
10	CALCULATION OF AIR MAGNIFICATION
11	CALCULATION OF CORRECTION AMOUNT OF AIR BLOW AMOUNT
12	CALCULATION OF CORRECTION FACTOR
13	CALCULATION OF AIR BLOW AMOUNT SET VALUE

[Fig.3]

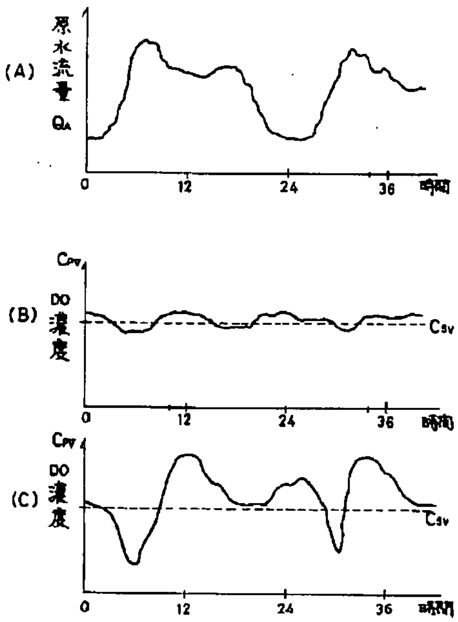


	(i)	GRADE
FIG. 3A	(ii)	DO CONCENTRATION DEVIATION (Et)
FIG. 3B	(iii)	DO CHANGE RATE (d)
FIG. 3C	(iv)	AIR MAGNIFICATION (e)
FIG. 3D	(v)	CORRECTION FACTOR (K)

[Fig.4]

(ii)

(i)



(i) TIME
FIG. 4A (ii) FLOW AMOUNT OF RAW WATER, Q_A
FIG. 4B (iii) DO CONCENTRATION
FIG. 4C (iii) DO CONCENTRATION